Temporal Trends in the Socioeconomic Gradient for Breast Cancer Mortality among US Women

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ABSTRACT

Temporal trends in breast cancer mortality among US women were examined for 1969 through 1989 by age, race, and county-level socioeconomic status (SES). The mortality ratio for high- relative to low-SES counties declined significantly among women 25 to 44, 45 to 64, and more than 65 years of age, respectively, from 1.13 to 0.96, 1.32 to 1.19, and 1.48 to 1.26. The narrowing of mortality occurred among Whites and, to a lesser extent, Blacks. A relative increase in either breast cancer incidence among women in lower SES counties or improved survival among women in higher SES counties (reflecting greater use of screening and treatment) could account for this relative worsening of breast cancer mortality among lower SES women in lower SES counties. (*Am J Public Health* 1994;84:1003–1006)

Introduction

Breast cancer kills more than 175 000 women throughout the world each year.[1] Among women in the United States, this malignancy accounted for an estimated 46 300 deaths in 1992.[2] Breast cancer mortality, in contrast to most other causes of death,[3] is greater among women having higher, as compared with lower, socioeconomic status (SES).[4,5]

Death statistics in the United States are routinely reported by gender and age but not by SES. Little is known, therefore, about how breast cancer mortality in this country has changed over time for women in different social classes. Because a woman's SES reflects to some degree her risk behaviors and exposure to possible carcinogens,[3–8] as well as her use of screening and treatment services,[3,8–10] investigation of mortality trends by SES may be valuable. In this paper, county-level data are used to examine the relation of SES indicators to breast cancer mortality over the last 2 decades among Black and White women in the United States.

Methods

County socioeconomic data (median family income and percentage of persons 25 years of age or older with at least a high school education) were obtained from the Area Resource File[11] for both the 1970 and 1980 census years. Other studies of breast cancer incidence[4,12–14] and mortality[6] have used these census-based socioeconomic indicators with regions ranging in size from census tract (or block groups) to the county level. Counties (n = 3075) were assigned to quintiles based on the rank of the value for each variable (Table 1). Because less than 15% of the population lived in the two lowest quintile counties, these quintiles were combined to minimize the variance of the ratio estimates.

County-based mortality data, obtained from the Compressed Mortality File,[15–17] were available on Whites separately for 1968 through 1989 and on Blacks separately for 1979 through 1989. Population estimates provided by the National Cancer Institute and death records obtained from the detailed mortality files of the National Center for Health Statistics were used to obtain data for Blacks in 1969 through 1972. Deaths of women 25 years of age or older with an *International Classification of Diseases* (ICD), Eighth Revision (adapted) or Ninth Revision, code of 174 were selected.

Data were combined over several pericensal years. Because the ICD version changed between 1978 and 1979, four (rather than five) pericensal years were combined (i.e., 1969 through 1972 and 1979 through 1982). Also, data from the most recent years (1987 through 1989) were combined.

Data from both files were merged (e.g., 1969 through 1972 deaths and population data were combined with the 1970 SES variables). Because county-level 1990 SES data were not yet available, the 1987 through 1989 mortality data were combined with 1980 SES data.

Statistics include age-specific rates (total number of age-specific deaths over the time period divided by total age-specific person-years); age-adjusted death rates (adjusted to the 1970 US age distribution[18]); standard errors or 95% confidence intervals (CIs) for rates and ratios[18]; and significance of trends of risk ratios.[19]

Results

Breast cancer mortality among US women aged 25 and over rose 3.0% from 1969 through 1972 to 1987 through 1989

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Note. The views expressed are the authors' and do not necessarily represent the policies of the authors' agencies.

TABLE 1—Distribution of Socioeconomic Variables, by Quintiles of Counties

Quintile	Median Family Income[a] 1969, $	1979, $	Total 1979 Population, %	Adult High School Graduates, % 1970	1980	Of Total 1980 Population
1	5 788	13 750	4.9	31.7	46.8	5.5
2	5788–6859	13 750–15 629	7.7	31.7–41.8	46.8–57.1	11.1
3	6860–7875	15 630–17 320	11.9	41.9–49.5	57.2–64.2	17.0
4	7876–8904	17 321–19 526	18.9	49.6–55.9	64.3–69.9	29.8
5	8 904	19 526	56.7	55.9	69.9	36.6
Minimum value	2 407	7 170		11.6	25.1	
Maximum value	18 333	33 711		88.2	95.3	

[a]The poverty level for a family of four was $3743 in 1969 and $7412 in 1979.

TABLE 2—Breast Cancer Mortality Rates among US Women, by Age and Race

Race/Age, y	Rate (95% Confidence Interval) 1969–1972	1979–1982	1987–1989
White			
All adults	49.6 (49.3, 49.9)	49.4 (49.1, 49.7)	50.7 (50.4, 51.0)
25–44	11.1 (10.9, 11.3)	9.8 (9.6, 10.0)	9.5 (9.3, 9.7)
45–64	64.4 (63.8, 64.9)	62.2 (61.7, 62.7)	61.1 (60.5, 61.7)
65+	110.9 (109.9, 111.9)	117.1 (116.2, 118.0)	127.2 (126.2, 128.2)
Black			
All adults	43.7 (42.8, 44.6)	49.5 (48.7, 50.3)	56.7 (55.7, 57.7)
25–44	13.1 (12.5, 13.7)	13.9 (13.3, 14.5)	15.9 (15.2, 16.6)
45–64	53.5 (51.9, 55.1)	65.8 (64.2, 67.4)	74.0 (72.1, 75.9)
65+	76.8 (73.9, 79.7)	100.8 (98.0, 103.6)	118.5 (115.3, 121.7)
All			
All adults	49.2 (48.9, 49.5)	49.0 (48.7, 49.3)	50.7 (50.4, 51.0)
25–44	11.5 (11.3, 11.7)	10.2 (10.0, 10.4)	10.1 (9.9, 10.3)
45–64	63.8 (63.3, 64.3)	62.0 (61.5, 62.5)	61.6 (61.0, 62.2)
65+	108.8 (107.9, 109.7)	114.9 (114.1, 115.7)	125.2 (124.5, 126.1)

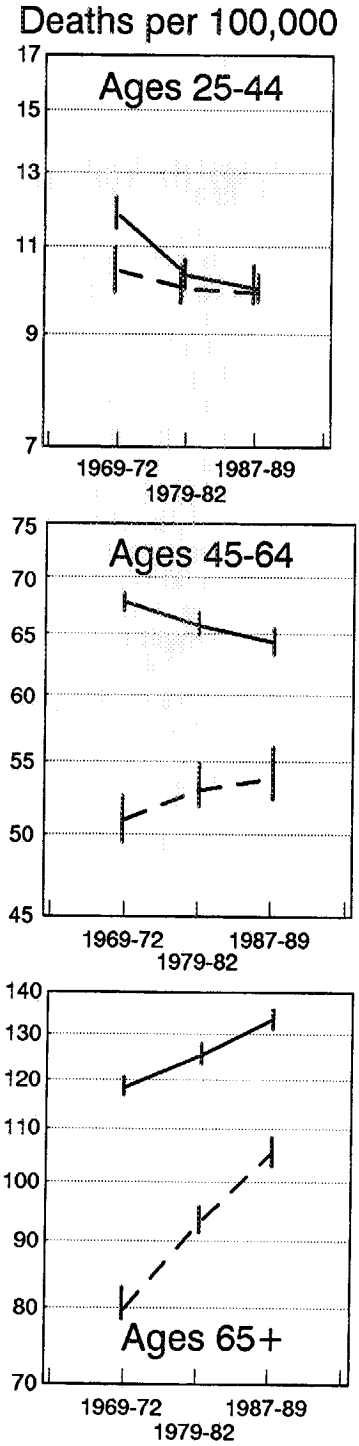
Note. Mortality rates are per 100 000 women. Mortality was age-adjusted to the 1970 US population.

(Table 2). Different trends are evident if the death statistics are broken down by age and race. Among Black women, mortality climbed 21.4% for those 25 to 44 years of age, 38.3% for those 45 to 64, and 54.3% for those over 64. Among Whites, mortality declined 14.4% among younger women and 5.1% among middle-aged women but increased 14.7% among older women.

The relative worsening of mortality for Blacks is reflected in trends for the Black–White mortality ratio. In the interval from 1969 through 1972 to 1987 through 1989, this ratio increased from 1.18 (95% CI = 1.12, 1.24) to 1.67 (95% CI = 1.59, 1.75) for women aged 25 to 44 years, from 0.83 (95% CI = 0.80, 0.86) to 1.21 (95% CI = 1.18, 1.24) for women 45 to 64, and from 0.69 (95% CI = 0.66, 0.72) to 0.93 (95% CI = 0.90, 0.95) for women 65 or older.

Figure 1 depicts breast cancer mortality trends among quintiles defined by county median family income for all races combined (see also Table 3). Despite the opposite trends of mortality in younger and older women, the SES differentials narrowed for both age groups. The SES differential also narrowed among middle-aged women. Education quintiles provide similar but slightly attenuated results both within time periods and over time (data are available from the authors on request).

Table 3 also presents, race, age-, income-, and time period–specific mortality as well as ratios of mortality among the



Lowest Quintiles (1 and 2) - - - -
Highest Quintile (5) ——
Note. Mortality rates (and confidence intervals, shown as vertical bars) are shown for 1969–1972, 1979–1982, and 1987–1989 among women 25–44 years old, 45–64 years old, and 65 years old or older. Death rates were age-adjusted to the 1970 US population.

FIGURE 1—Breast cancer mortality, by quintile of median family income (multiyear averages).

highest quintile populations and the two lowest quintile populations. Among Whites, all of the changes in ratios were significant. For Black women, the high–low mortality ratio was unchanged among the younger women and decreased somewhat for the other age groups, in part because of a substantial breast cancer mortality increase in the poorer counties.

Discussion

Our study shows a narrowing of the direct SES differential in the breast cancer gap over the past 2 decades among US women for each age and race group (except the youngest Black women). Breast cancer mortality, which has been rising among women 65 years of age and older, has increased more rapidly among those in lower SES counties. Among women 45 to 64, breast cancer mortality has been declining in those women in higher SES counties but rising in their lower SES counterparts. Finally, women 25 to 44 have experienced a fall in breast cancer death rates over the last 2 decades, with the decline being more rapid in those in higher SES counties. Earlier data (through 1971) from the United Kingdom suggest a similar shrinking of the social class gradient in breast cancer mortality.[7]

These analyses were areal (or "ecologic"). County-level SES may be a proxy for *individual-level* measures (e.g., income, education, and type of health insurance) or a reflection of *county-level* characteristics (e.g., population density, pollution, and availability of screening and treatment services). Indeed, there may be a mix of individual- and county-level factors at work. Further studies using census tracts or blocks or other areas smaller than the county for ascribing SES might reduce the classification error known to exist in ecologic analyses.[20–22]

Data from other studies suggest that these observed SES trends in breast cancer mortality can be explained by changes in both incidence and survival. Cross-sectional ecologic analyses by SES indicate that breast cancer incidence is greater among women of higher SES.[4,23] However, between 1974 and 1984, the incidence in the Seattle region increased more rapidly among women living in low-income census tracts.[14] Use of both mammography[9] and breast examination[9,10] has been shown to be lower and to have increased more slowly between 1974 and 1984 among poorer or less educated women in the United States. Cross-sectional data indicate that lower SES

TABLE 3—Breast Cancer Mortality Rates among US Women, by Age, Race, and Median Family Income Quintiles

Age, y	Race	Income Quintile	Rate (95% Confidence Interval) 1969–1972	1979–1982	1987–1989
25–44	White	Q5 (high)	11.6 (11.4, 11.8)	10.1 (9.9, 10.3)	9.5 (9.3, 9.7)
		Q4	10.4 (9.8, 11.0)	9.3 (8.9, 9.7)	9.3 (8.9, 9.7)
		Q3	10.3 (9.5, 11.1)	9.7 (9.1, 10.3)	9.9 (9.3, 10.5)
		Q2	9.7 (8.7, 10.7)	9.3 (8.5, 10.1)	9.2 (8.4, 10.0)
		Q1 (low)	9.7 (8.7, 10.7)	9.4 (8.4, 10.4)	9.8 (8.8, 10.8)
		Q5:Q1, 2	1.20 (1.09, 1.31)	1.07 (1.00, 1.14)	1.01 (0.94, 1.08)
		Trend: P=.03			
	Black	Q5 (high)	12.5 (11.7, 13.3)	14.2 (13.2, 15.2)	15.7 (14.7, 16.7)
		Q4	14.0 (12.2, 15.8)	13.5 (11.9, 15.1)	16.6 (14.8, 18.4)
		Q3	17.7 (14.8, 20.6)	13.5 (11.7, 15.3)	15.8 (13.6, 18.0)
		Q2	10.8 (8.4, 13.2)	14.0 (12.0, 16.0)	15.8 (13.4, 18.2)
		Q1 (low)	13.5 (11.0, 16.0)	12.4 (10.0, 14.8)	15.1 (12.4, 17.8)
		Q5:Q1, 2	1.03 (0.86, 1.19)	1.06 (0.91, 1.21)	1.01 (0.89, 1.13)
		Trend: P=.50			
	All	Q5 (high)	11.8 (11.6, 12.0)	10.4 (10.2, 10.6)	10.0 (9.8, 10.2)
		Q4	11.0 (10.4, 11.6)	9.7 (9.3, 10.1)	10.0 (9.4, 10.6)
		Q3	11.3 (10.5, 12.1)	10.3 (9.7, 10.9)	10.6 (9.7, 11.2)
		Q2	10.3 (9.5, 11.1)	10.1 (9.7, 10.9)	10.2 (9.4, 11.0)
		Q1 (low)	10.5 (9.5, 11.5)	9.9 (9.1, 10.7)	10.8 (9.8, 11.8)
		Q5:Q1, 2	1.13 (1.06, 1.20)	1.04 (0.96, 1.12)	0.96 (0.91, 1.02)
		Trend: P=.02			
45–64	White	Q5 (high)	68.2 (67.4, 69.0)	65.6 (64.8, 66.4)	64.7 (63.9, 65.5)
		Q4	62.4 (61.0, 63.8)	58.3 (57.1, 59.5)	58.5 (57.1, 59.9)
		Q3	54.6 (52.8, 56.4)	57.0 (55.4, 58.6)	57.6 (55.8, 59.4)
		Q2	52.4 (50.2, 54.6)	55.3 (53.5, 57.1)	54.2 (52.0, 56.4)
		Q1 (low)	49.9 (47.5, 52.3)	50.4 (48.2, 52.6)	50.6 (48.1, 53.1)
		Q5:Q1, 2	1.32 (1.28, 1.36)	1.23 (1.20, 1.26)	1.23 (1.19, 1.27)
		Trend: P=.02			
	Black	Q5 (high)	56.9 (54.7, 59.1)	68.4 (65.9, 70.9)	75.9 (73.2, 78.6)
		Q4	53.0 (49.1, 56.9)	68.2 (64.3, 72.1)	78.5 (73.8, 83.2)
		Q3	49.4 (44.1, 54.7)	68.0 (63.9, 72.1)	74.1 (69.0, 79.2)
		Q2	46.8 (41.7, 51.9)	58.9 (54.4, 63.4)	65.0 (59.7, 70.3)
		Q1 (low)	44.3 (39.6, 49.0)	50.4 (45.3, 55.5)	63.9 (57.2, 70.6)
		Q5:Q1, 2	1.25 (1.14, 1.36)	1.23 (1.14, 1.32)	1.17 (1.09, 1.25)
		Trend: P = .14			
	All	Q5 (high)	67.7 (67.1, 68.3)	65.7 (65.0, 66.4)	64.4 (63.6, 65.2)
		Q4	62.1 (60.9, 63.3)	59.2 (58.0, 60.4)	59.9 (58.5, 61.3)
		Q3	54.7 (52.9, 56.5)	58.4 (57.0, 59.8)	59.3 (57.7, 60.9)
		Q2	52.5 (50.5, 54.5)	55.6 (53.8, 57.4)	55.3 (53.3, 57.3)
		Q1 (low)	49.5 (47.3, 51.7)	50.3 (48.3, 52.0)	52.2 (50.8, 54.6)
		Q5:Q1, 2	1.32 (1.28, 1.36)	1.23 (1.20, 1.26)	1.19 (1.15, 1.23)
		Trend: P=.01			
65+	White	Q5 (high)	120.3 (118.9, 121.7)	125.3 (124.1, 126.5)	136.2 (134.8, 137.6)
		Q4	105.0 (102.6, 107.4)	109.0 (107.0, 111.0)	121.5 (119.3, 123.7)
		Q3	96.1 (93.2, 99.0)	109.8 (107.4, 112.2)	119.7 (117.0, 122.4)
		Q2	86.0 (82.3, 89.7)	100.9 (98.0, 103.8)	110.2 (106.9, 113.5)
		Q1 (low)	75.6 (71.9, 79.3)	89.9 (86.2, 93.6)	102.6 (98.7, 106.5)
		Q5:Q1, 2	1.48 (1.43, 1.53)	1.30 (1.27, 1.33)	1.27 (1.24, 1.30)
		Trend: P=.005			
	Black	Q5 (high)	87.4 (82.9, 91.9)	111.5 (106.8, 116.2)	122.3 (117.2, 127.4)
		Q4	71.5 (65.0, 78.0)	103.5 (97.2, 109.8)	125.6 (118.2, 133.0)
		Q3	69.3 (60.5, 78.1)	98.3 (91.8, 104.8)	121.3 (113.5, 129.1)
		Q2	64.1 (56.1, 72.1)	95.1 (87.7, 102.6)	107.7 (99.3, 116.5)
		Q1 (low)	65.4 (58.1, 72.7)	66.2 (59.3, 73.1)	95.7 (86.3, 105.1)
		Q5:Q1, 2	1.34 (1.21, 1.47)	1.36 (1.26, 1.46)	1.19 (1.10, 1.28)
		Trend: P=.11			
	All	Q5 (high)	118.6 (117.4, 119.8)	125.1 (123.9, 126.3)	133.3 (131.9, 134.7)
		Q4	102.8 (100.6, 105.0)	108.1 (106.3, 109.9)	121.1 (118.9, 123.3)
		Q3	94.8 (92.1, 97.5)	108.4 (106.2, 110.6)	119.2 (116.7, 121.7)
		Q2	84.4 (81.3, 87.5)	99.6 (96.9, 102.3)	109.1 (106.2, 112.0)
		Q1 (low)	75.4 (71.7, 79.1)	85.7 (82.8, 88.6)	101.3 (97.8, 104.8)
		Q5:Q1, 2	1.48 (1.43, 1.53)	1.33 (1.30, 1.36)	1.26 (1.23, 1.29)
		Trend: P=.005			

Note. Mortality rates are per 100 000 women. Mortality was age-adjusted to the 1970 US population. Q5:Q1, 2 = rate ratio of mortality in highest income quintile (Q5) to population-based weighted average mortality of two lowest income quintiles (Q2 and Q1). Because of the nature of ratio estimates, the ratio for the total population is not a simple average of the ratios for each subpopulation. Trend = test for trend over time of ratios of Q5 to Q1 and Q2 (combined).

women present at a more advanced stage of disease.[24] Whether treatment differentials by SES play a role is unclear. Thus, the diminishing mortality gap over time among women living in high- as compared with low-SES counties may reflect (1) a more rapidly rising incidence of breast cancer among younger women in low-income counties or (2) greater survival among women in high- income, or poorer survival among women in low-income, counties.

Women in lower SES counties appear to be reaching "equity" in breast cancer mortality with those living in higher SES counties. This, unfortunately, is not the kind of SES equity one might hope for. Further investigations of temporal trends in the SES distribution of risk factors (for incidence and survival) might provide additional etiologic leads and direct attention to deficiencies in breast cancer medical services. This would benefit women from all social strata. □

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References

1. *World Health Statistics Annual 1990.* Geneva, Switzerland: World Health Organization; 1991.
2. *Cancer Facts and Figures, 1992.* Atlanta, Ga: American Cancer Society; 1992.
3. Pappas G, Queen S, Hadden W, Fisher G. The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. *N Engl J Med.* 1993; 329:103–109.
4. Devesa SS, Diamond EL. Association of breast cancer and cervical cancer incidences with income and education among whites and blacks. *J Natl Cancer Inst.* 1980;65:515–528.
5. Hakama M, Hakulinen T, Pukkala E, et al. Risk indicators of breast and cervical cancer on ecologic and individual levels. *Am J Epidemiol.* 1982;116:990–1000.
6. Kelsey JL. A review of the epidemiology of human breast cancer. *Epidemiol Rev.* 1979; 1:74–109.
7. Logan WP. *Cancer Mortality by Occupation and Social Class 1851–1971.* London, England: Her Majesty's Stationery Office; 1982. Studies on Medical and Population Subjects 44.
8. Angell M. Privilege and health—what is the connection? *N Engl J Med.* 1993;329: 126–127.
9. Dawson DA, Thompson GB. Breast cancer risk factors and screening: United States, 1987. *Vital Health Stat [10].* 1990; 172. DHHS publication PHS 90-1500.
10. Makuc DM, Freid VM, Kleinman JC. National trends in the use of preventive health care by women. *Am J Public Health.* 1989; 79:21–26.
11. Stambler HV. The Area Resource File—a brief look. *Public Health Rep.* 1988;103: 184–188.
12. McWhorter WP, Schatzkin AG, Horm JW, Brown CC. Contribution of socioeconomic status to black/white differences in cancer incidence. *Cancer.* 1989;63:982–987.
13. Baquet CR, Horm JW, Gibbs T, Greenwald P. Socioeconomic factors and cancer incidence among blacks and whites. *J Natl Cancer Inst.* 1991;83:551–556.
14. White E, Daling JR, Norsted TL, Chu J. Rising incidence of breast cancer among young women in Washington State. *J Natl Cancer Inst.* 1987;79:239–243.
15. Ingram DD, Gillum RF. The Mortality Surveillance System and its application tothe study of ischemic heart disease mortality. *J Am Stat Assoc.* 1987;82:324–327.
16. Ingram DD, Gillum RF. Regional and urbanization differentials in coronary heart disease mortality in the United States, 1968–85. *J Clin Epidemiol.* 1989;42:857–868.
17. *Public Use Data Tape Documentation: Compressed Mortality File, 1968–1985.* Hyattsville, Md: National Center for Health Statistics; 1989.
18. Kleinman JC. Mortality. In: *Statistical Notes for Health Planners No. 3.* Washington, DC: US Dept of Health, Education and Welfare; 1977. DHEW publication HRA 77-1237.
19. Rothman KJ. *Modern Epidemiology.* Boston, Mass: Little, Brown; 1986:343–344.
20. Alker JR Jr. A typology of ecologic fallacies. In: Doggan M, Rokkan S, eds. *Social Ecology.* Cambridge, Mass: MIT Press; 1969:69–86.
21. Haan M, Kaplan G, Camacho T. Poverty and health: prospective evidence from the Alameda County study. *Am J Epidemiol.* 1987;125:989–998.
22. Krieger N. Overcoming the absence of socioeconomic data in medical records: validation and application of a census-based methodology. *Am J Public Health.* 1992; 82:703–710.
23. Krieger N. Social class and the black/white crossover in the age-specific incidence of breast cancer: a study linking census-derived data to population-based registry records. *Am J Epidemiol.* 1990; 131:804–814.
24. Wells BL, Horm JW. Stage at diagnosis in breast cancer: race and socioeconomic factors. *Am J Public Health.* 1992;82:1383–1385.

Candidates Sought for Reproductive Health Initiative Awards

The American Medical Women's Association (AMWA) announces its first Reproductive Health Initiative Awards to recognize physicians who have made outstanding contributions to reproductive health for women. The $10 000 national award will be presented to a male or female physician who is a prominent and well-known current reproductive health care provider and who, in the view of AMWA, has made significant contributions to advancing women's reproductive health and has attempted to bring these issues into mainstream medicine.

AMWA will consider candidates who have dedicated personal time and their professional career to providing quality reproductive health care services, including abortion services. Potential awardees will be those who have provided leadership and education and who have promoted reproductive health issues on a national level.

The new award is part of AMWA's Reproductive Health Initiative, a 3-year project to develop and promote curricula that medical schools can use to train medical students in reproductive health. Interested medical schools can participate in the initiative training by holding 1-day seminars. In addition, AMWA will arrange for fourth-year medical students to be trained in reproductive health.

To be considered for the national award, those nominating potential candidates should provide a nomination statement between 50 and 250 words and send it with the nominee's curriculum vitae, nomination form, and other relevant supporting information to AMWA by *Friday, July 22, 1994.* For a national application, contact Susan Eisendrath, MPH, Project Coordinator-RHI, c/o AMWA, 801 N Fairfax St, Alexandria, VA 22314; tel (703) 838-0500.

Five local awards of $1000 each will be granted through AMWA branches. To be considered for a local award, contact AMWA for the name of the president of the branch in your area.